Minnesota
Department of
Employee
Relations

Leadership and partnership in human resource management

June 27, 1994

The Docket Office
Docket No. H-122
Room N-2625
U.S. Dept. of Labor
200 Constitution Avenue NW
Washington, DC 20210

9-26820

Dear OSHA:

Your proposed standard on Indoor Air Quality is a good start.

I would like to see an appendix added to this standard which has recommended guidelines for the location of fresh air intakes, proper filtration of airstreams, and regular cleaning procedures for cooling coils, drainage pans and adjacent ductwork. Included with this letter are my proposals for materials to be included in this appendix.

I am a registered Professional Engineer and certified in the Comprehensive Practice of Industrial Hygiene by the American Board of Industrial Hygiene. I have worked on issues involving indoor air quality in buildings for twenty years, seventeen years with the Minnesota Department of Health and Minnesota OSHA and four years with the Minnesota Department of Employee Relations. Over the past twenty years, I have conducted hundreds of comprehensive indoor air quality investigations in office buildings.

For the past four years I have been responsible for the indoor air quality in any of 3,000 state owned and leased buildings in Minnesota. Design and maintenance problems are very common in these buildings. I have learned that vague guidelines (your standard has many of these in it) tend to be confusing and having specific guidelines similar to those attached to this letter help in increasing the knowledge and understanding of building operators.

Sincerely,

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cc: Darcel Lewis - EID/CSU

Guidelines For The Location of Fresh Air Intakes

Ventilation systems must be designed to prevent reentrainment of exhaust contaminants. Makeup or fresh air intakes and exhaust air outlets must be located such that exhaust air does not contaminate the makeup air. By careful placement of the intakes, contaminants from sources such as cooling towers, sanitary vents, clothes dryer vents, kitchen exhaust hood vents, vehicular exhaust from parking garages, loading docks, and street traffic can be avoided. The cost of correcting air intake problems after initial construction can be quite high.

1. Location of Fresh Air Intakes

   In virtually all cases fresh air intakes should be mounted low on the roof of a building and located no closer than 10 feet to the edge of the roof. When this is not possible, potential contamination sources must be carefully evaluated.

   Extending fresh air intakes relatively short distances of 10 to 20 feet above a roof is normally counterproductive because most contamination sources have a thermal head and tend to rise soon after being released outside. Extending the fresh air intake 20 or more feet above the roof can be very beneficial but typically is not very practical in most cases. In some cases extending the height of the fresh air intake could make the situation worse rather than better.

   It is usually advantageous to keep fresh air intakes low on the roof and to direct contamination exhaust as high off the roof as possible. Weather caps which deflect exhaust air downward are not recommended because they tend to keep contaminated air relatively close to the roof surface when the goal should be to direct the contaminated air upward away from the roof. Potential contamination sources should have a vertical discharge stack, when possible.

2. Recommended Distance Requirements

   When installing fresh air intakes it is very important to consider the quantity and type of contamination that are possible and also the distance and direction of contamination sources with respect to the fresh air intake. The following distance requirements should apply under most normal conditions. Fresh air intakes should not be located closer than the following distances from potential contamination sources:

   a. Small confined contamination sources - such as sanitary vents.

      The fresh air intake should be installed no closer than 20 feet from such openings. This distance can be a combination of vertical and horizonal distances. For example, if the vent exhausts at an elevation 10 feet higher than the fresh air intakes, then the horizonal distance can be reduced to 10 feet.

b. Large confined contamination sources - such as clothes dryer vents, flue gas vents from combustion heaters, exhaust vents from parking garages, laboratory vent hoods and cooking exhaust vents.

   If the potential contamination source (i.e. cooking exhaust vent) has a vertical discharge stack extending at least 5 feet higher than the height of the fresh air intake on the roof, then the fresh air intake may be located no closer than 40 feet horizontal from the potential contamination source.

   If the potential contamination source (i.e. cooking exhaust vent) <u>does not have</u> a vertical discharge stack extending at least 5 feet higher than the height of the fresh air intake on the roof, then the fresh air intake may be located no closer than 60 feet horizontal from the potential contamination source.

c. Large non-confined contamination sources - such as cooling towers, parking areas, and loading docks (loading dock area boundaries include the area where vehicles park while loading and unloading).

   The fresh air intake should be located no closer than 100 feet to the potential contamination source. This distance may be a combination of horizontal and vertical distances but the horizontal distance may never be less than 40 feet.

HVAC Critical Areas For Cleaning

Building heating, ventilating and air conditioning (HVAC) systems can function as reservoirs or amplification sites for microorganisms. The most common amplification sites identified in buildings are the cooling coils and adjacent areas of the HVAC system. During periods when the humidity levels outdoors are high (outdoor dew points at or above 60 degrees), the relative humidity inside the supply air ductwork in air-conditioned buildings can increase to levels above 70 percent. When outdoor dew points are above 60 degrees, the air entering the cooling coils is dehumidified and water condenses on the cooling coils and is drained away. Air leaving the cooling coils, when the outdoor dew point is above 60 degrees, is typically at a temperature of 55 - 57 degrees with a relative humidity of 90 percent plus. This environment is ideal for microbe growth if a suitable site for growth and a food source exists. There are three potential growth sites in the cooling coil area:

a. The cooling coils - Debris can built up on the coiling coils (especially on the upstream side of the coils) and act as a food source for the microbes. This area is a high humidity area during the cooling season.

b. The cooling coils drainage area - Debris can built up in the drainage pans and act as a food source for the microbes to grow in this area. In addition, the debris can block the drainage from the cooling coils and cause water to be sprayed or leaked on to the ductwork downstream from the cooling coils. Drainage systems which are not properly engineered will not drain and will allow standing water to accumulated in the drainage pans and/or adjacent ductwork.

c. Ductwork downstream and adjacent to cooling coils - Any ductwork in areas where the relative humidity is greater than 70 percent has a good potential for undesirable microbe growth if a suitable site for growth and a food source exists. The suitable site in many buildings are the rough porous surfaces on ductwork adjacent to cooling coils (within ten feet up and downstream of this area is the most critical). The food source is any dust which travels with the air being circulated in the ventilation system which collects on these rough porous surfaces. The microbes grow on the dirt which has collected on the rough surfaces.

Total elimination of microorganisms from buildings is not possible. The goal of building operations is to keep the population of microorganisms within reasonable levels. All buildings should have easy access "clean out doors" upstream and downstream of cooling coils. The three areas mentioned above need to be cleaned with a cleaning solution in March or April and September or October of each year. This cleaning needs to include ductwork 5 feet upstream and downstream of the cooling coils.

Note: Remove/cover up/coat any porous interior liners which are present within ten feet upstream and downstream of the cooling coils before cleaning is done in this area. Porous liners are difficult/impossible to clean and should not be present in areas adjacent to cooling coils.

The interior surface of ductwork within ten feet upstream and downstream of cooling coils should be an impermeable easy to clean surface like bare galvanized metal. The goal in high moisture areas, interior ductwork surfaces within ten feet upstream and downstream of the cooling coils is to provide a washable impermeable surface.

HVAC Air Filtration

The quality of filters used in buildings varies greatly. The three most common filter media are the following:

a. Unrated filters - These filters are very similar to the type used by homeowners to filter the air in forced air heating systems. Filter efficiencies are not typically known but are very low (less than 1 - 15 percent in most cases). These types of filter are designed primarily to be prefilters and should not be used as the only filter in the ventilation system. HVAC systems using these types of filters will allow large quantities of dirt to be present inside the HVAC system. These types of filters/system **are not recommended as the only filtration system for office buildings.**

b. 25 - 35 percent efficient filters - These filters are typically called pleated filters and their collection efficiency is certified by the manufacturer using the ASHRAE Standard 52-76 Atmospheric Dust Spot Efficiency Test. These filters are very effective at filtering dirt out of return air streams and is the **lowest quality filter recommended to use in an office building.** Normally these filters come in 1, 2 and 4 inch thick sizes with the 2 inch filters used the most often (a 2 or 4 inch thick filter has a lower pressure drop (lower resistance to air flow) then a 1 inch filter). The thicker filters have a lower resistance to air flow and the resistance to air flow increases slower with increasing dirt load then the thinner filters. The normal cost for a typical 20 by 20 inch filter is 2 to 10 dollars.

c. 40 - 85 percent efficient filters - These filters are typically used in health care facilities when very clean air is desired. A large number of new buildings built today are starting to use these types of filters to improve overall air quality in buildings.

It is impossible to filter all the dirt out of the air stream and some dirt will always find its way into the ductwork. Better filtration will clearly limit the quantity of dirt (or food) which will be present inside HVAC systems. Most of the filters described above become more efficient at collecting dirt, as the filters become dirty, however their resistance to air flow also increases, so by pass around the filters will become more pronounced with increasing dirt load. Filters need to be changed regularly and this will vary from building to building to some extend. For most buildings a filter changing schedule of three times per year is recommended. Change filters in the spring (clean cooling coils at this time) normally in March or April, mid summer and in the fall normally in September or October (clean cooling coils at this time). For buildings using high efficient bag filters, **which have good quality prefilters which are changed three times per year**, the bags should be changed every 2 to 3 years.

Ductwork should be cleaned on a regular basis. Standard galvanized ductwork should be cleaned every 20 to 30 years. Reheat coils should be cleaned every 10 years. Cleaning ductwork lined with fiberglass on the inside is very difficult and should always be approached with caution. This type of ductwork collects dirt very effectively and normally within 10 to 20 years will need to be cleaned/coated or replaced.